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establish prima facie obviousness. Applicants respectfully request reconsideration of the rejection based on the following comments.

The Examiner maintains that the Bhargava patent discloses ZnO. In particular, the Examiner asserts that II-VI semiconductors include ZnO. The Examiner further asserts that Y_2O_3 is also a II-VI semiconductor. With respect to yttrium oxide, the Bhargava patent at column 2, lines 25-27 indicates that yttrium oxide is an "other suitable host" **besides II-VI hosts**. Yttrium is a rare earth metal of group IIIB of the periodic table, and Y^{+3} is certainly not a divalent metal. However, the Bhargava patent is not written precisely since ZnS is listed again with these other suitable hosts. However, Applicants do not believe that the Examiner is correct with respect to the assertion that II-VI semiconductors include ZnO. Furthermore, **Bhargava does not explicitly list ZnO.**

II-VI semiconductors generally include a member of periodic table group IIb (Zn, Cd, Hg), which are divalent, combined with (S, Se or Te), which are elements of Group VIA. While some patents refer to "group II-VI semiconductors", Applicants' undersigned representative could not identify any that listed an oxide within this group. Kittel, a foremost expert in the field, refers in his book at page 199 to "II" and "VI" as referring to valency and not to the group of the periodic table. What confuses the issue is that the group of the periodic table can correlate with valency. S, Se and Te all form hexavalent compositions SF_6 , SeF_6 , and TeF_6 , while oxygen does not and cannot form hexavalent compounds, because there are no d-orbitals available. Thus, oxygen is not hexavalent, although it is in group VIA of the periodic table. Thus, according to the explanation in the Kittel textbook at page 199, oxygen would not be an element in a II-VI semiconductor. Regardless of the precise explanation for the terminology, Applicants have not been able to identify any source that considers zinc oxide a II-VI semiconductor.

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Jaskie does not cure the clear deficiencies of the Bhargava patent with respect to teaching zinc oxide. In summary, the primary reference to Bhargava does not disclose zinc oxide, and the Jaskie reference does not make up for these deficiencies. Therefore, Applicants' believe that the Examiner has failed to establish a prima facie showing that the Bhargava patent alone or combined with the Jaskie patent teaches zinc oxide.

Furthermore, the Jaskie patent does not enable the production of zinc oxide particles with the claimed particle size. The Jaskie patent presents a theoretical description of how quantum confined phosphors with a selected particle size would have a particular emission wavelength. Then, the patent provides a vague prophetic description about obtaining arbitrarily desired particles. Applicants believe that the vague description falls short of establishing prima facie obviousness.

Assuming *arguendo* that prima facie obviousness has been established, Applicants have presented un-refuted objective evidence in response. With the Amendment of August 17, 2002, Applicants submitted Declarations by Professor Rajiv Singh and Professor Terry Bricker. These Declarations make it clear that the disclosure in the Jaskie patent does not provide a reasonable expectation of success with respect to forming zinc oxide as claimed by Applicants.

The courts have indicated that affidavits must be accorded weight if they provide evidence on unobviousness. "Insofar as these affidavits provide evidence to support the legal conclusion of unobviousness under 35 U.S.C. 103, they must be considered. Statements of opinion in an affidavit must be accorded some weight as bearing upon the legal conclusion required by 35 U.S.C. 103." In re Metcalf, 157 USPQ 423, 426 (CCPA 1968)(citations omitted).

The proposition is well established that the prior art only renders a composition of matter or apparatus unpatentable to the extent that the prior art provides a means of obtaining the

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composition or apparatus. If the prior art does not teach a method of making the composition of matter, the public is not in possession of the composition of matter.

To the extent that anyone may draw an inference from the Von Bramer case that the mere printed conception or the mere printed contemplation which constitutes the designation of a 'compound' is sufficient to show that such a compound is old, regardless of whether the compound is involved in a 35 U.S.C. 102 or 35 U.S.C. 103 rejection, we totally disagree. ... We think, rather, that the true test of any prior art relied upon to show or suggest that a chemical compound is old, is whether the prior art is such as to place the disclosed 'compound' in the possession of the public.

In re Brown, 141 USPQ 245, 248-49 (CCPA 1964)(emphasis in original)(citations omitted).

Similarly, see In re Hoeksema, 158 USPQ 596, 600 (CCPA 1968)(emphasis in original):

We are certain, however, that the invention as a whole is the claimed compound and a way to produce it, wherefore appellant's argument has substance. There has been no showing by the Patent Office in this record that the claimed compound can exist because there is no showing of a known or obvious way to manufacture it; hence, it seems to us that the 'invention as a whole,' which section 103 demands that we consider, is not obvious from the prior art of record.

While there are valid reasons based on public policy as to why this defect in the prior art precludes a finding of obviousness under section 103, In re Brown, supra, its immediate significance in the present inquiry is that it poses yet another difference between the claimed invention and the prior art which must be considered in the context of section 103. So considered, we think the differences between appellant's invention as a whole and the prior art are such that the claimed invention would not be obvious within the contemplation of 35 U.S.C. 103.

These issues were considered explicitly in In re Grose, 201 USPQ 57 (CCPA 1979).

The issue in the Grose case was the crystal structure of zeolites in a collection of zeolite particles. Crystal structure, like particle size distribution, is a chemical/ compositional property of the

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composition of matter. The zeolites in the Gross case were collections of particles, i.e., a powder.

The relevant issues are well stated in In re Grose:

Though nonobviousness of appellants' process for preparing their claimed composition would not be determinative of nonobviousness of the composition, a holding that the composition would have been nonobvious would require that the prior art fail to disclose or render obvious a process for preparing it.

[I]f the prior art of record fails to disclose or render obvious a method for making a claimed compound, at the time the invention was made, it may not be legally concluded that the compound itself is in the possession of the public. In this context, we say that the absence of a known or obvious process for making the claimed compounds overcomes a presumption that the compounds are obvious. ***

In re Hocksema, 55 CCPA 1493, 1500, 399 F.2d 269, 274, 158 USPQ 596, 601 (1968)(foot note omitted). Failure of the prior art to disclose or render obvious a method for making any composition of matter, whether a compound or a mixture of compounds like a zeolite, precludes a conclusion that the compound would have been obvious.

In re Grose, 201 USPQ at 63-64 (emphasis added). Applicants note that in In re Grose the zeolites had the same chemical formula as the prior art zeolites and only differed in crystal structure.

The Federal Circuit has further emphasized these issues. "But to be prior art under section 102(b), a reference must be enabling. That is, it must put the claimed invention in the hands of one skilled in the art." In re Sun, 31 USPQ2d 1451, 1453 (Fed. Cir. 1993)(unpublished). Assertions in a prior art reference do not support an anticipation or obviousness rejection unless the references place the claimed invention in the hands of the public. Beckman Instruments Inc. v. LKB Produkter AB, 13 USPQ2d 1301, 1304 (Fed. Cir. 1989). "In order to render a claimed apparatus or method obvious, the prior art must enable one skilled in the art to make and use the apparatus or method." Id. While a reference is prior art for all that it teaches, references along with

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the knowledge of a person of ordinary skill in the art must be enabling to place the invention in the hands of the public. In re Paulsen, 31 USPQ2d 1671, 1675 (Fed. Cir. 1994). See also In re Donohue, 226 USPQ 619, 621 (Fed. Cir. 1985).

In evaluating obviousness, the level of skill in the art must be considered. MPEP §2141, citing Graham v. John Deere, 383 U.S. 1, 148 USPQ 459 (1966). In the present case, a person of ordinary skill in the art would have, at least, a bachelors degree in electrical engineering, material science or physics, and with experience in particle technology and/or the fluorescent properties of material. As note in Professor Singh's Declaration, the technology discussed in the Jaskie Patent for particle separation is unconventional in the technology area. Therefore, we have also look to a person of high skill in the separation technology to evaluate the disclosure of wet filtration in the Jaskie patent. However, a person of ordinary skill in the art of fluorescent nanoparticles would be a person with skill in inorganic material science, electrical engineering or physics and would have limited, if any, understanding of chromatographic separation technology since such separation technology is unconventional in inorganic particle and phosphor particle technology. Therefore, Applicants believe that Professor Bricker would have significant extraordinary skill in separation technology relative to a person of ordinary skill in the relevant technology.

Under a factual inquiry relating to an obviousness analysis, objective evidence must be considered. See, MPEP §2141, and Graham v. John Deere, 383 U.S. 1, 148 USPQ 459 (1966). Applicants have presented two Declarations with the Amendment of August 17, 2001 under 37 C.F.R. §1.132. "In assessing the probative value of an expert opinion, the examiner must consider the nature of the matter sought to be established, the strength of any opposing evidence, the interest of the expert in the outcome of the case, and the presence and absence of factual support for the expert's opinion." MPEP 716.01(c) (Emphasis added). These statements in the MPEP are

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consistent with the statements of the Supreme Court in Graham v. John Deere. However, the Examiner has not responded in any way to the presentation of the Declarations.

The Jaskie patent includes a description of a "wet filtering technique" at column 7, lines 28-40. This wet filtration involves the formation of a suspension of the particles and the use of a cloth put into the suspension to draw up the particles. Professor Bricker's Declaration is specifically directed to extreme deficiencies of the wet filtration approach described in the Jaskie patent. Professor Bricker's Declaration also describes why other chromatographic techniques, including well established methods, would not be expected to accomplish the extremely fine separation needed to obtain the claimed invention.

Professor Bricker is an expert in separation technologies similar to the "wet filtration" approaches described in the Jaskie patent at column 7, lines 28-40, as applied in established organic chemical and biochemical fields. In addition, these techniques have been generalized for the separation of biological macromolecules, which have a nanometer size scale but very different chemical properties from inorganic particles. Dr. Bricker's Declaration presents an explicit and clear explanation of why the process described in the Jaskie patent cannot and will not work for the intended purpose, i.e., separating inorganic nanoparticles. Thus, **Applicants have presented clear objective evidence that the Jaskie patent does not enable the production of Applicants' claimed invention.** Applicants note that Professor Bricker has no interest in the outcome of the present application.

In the present case, the nature of the matter sought to be established as existing in the prior art, i.e., size separation of nanoparticles by chromatography, is at best speculative. It is difficult to establish that a method that has never been tried is not a useful approach. To establish a new method of purifying nanoparticles based on the minimal guidance from the Jaskie patent is at most an invitation to perform extensive research in the hopes that it may work. Professor Singh's Declaration addressed the relevant issues from the perspective of an expert in the field of inorganic

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particles regarding the suggestions in the Jaskie patent. There is no reasonable expectation of success.

Nevertheless, to confirm that Dr. Singh's expert statements were well founded, Applicants obtained a Declaration from an expert in chromatography, Dr. Bricker, who has directly addressed the disclosure in the Jaskie patent. Professor Bricker concluded that the Jaskie "wet filtration" will not work to separate nanoparticles. Dr. Bricker's expert Declaration has presented objective evidence to directly address the issues raised in the Jaskie patent. The conclusions that follow from Dr. Bricker's analysis are consistent with and support Dr. Singh's statements. Dr. Bricker was not aware of Dr. Singh's Declaration.

In addition, Applicants present additional objective evidence herewith that the conventional filtering approaches available for nanoparticles are not sufficient to perform the necessary particle separation to practice Applicants' claimed invention. In particular, we have supplied product literature from Millipore, a leader in particle separation technology. Specifically, Applicants have enclosed information downloaded from the Millipore Corporation (Millipore) web site. Millipore is a leader in filtration technology. Uniformity of particles is also a desirable feature for inorganic particles used in the fine polishing of electronic substrates, generally referred to chemical-mechanical polishing or CMP. This information from the Millipore website indicates that in 1999 standard CMP slurries have a significant fraction of larger particles combined with the desired nanoscale particles.

A plot from Millipore of the removal capability of Millipore's line of Planargard™ filters used to filter surface polishing slurries is included in the enclosed materials. These filters are not perfectly effective for removing particles even with diameters of greater than one micron. In addition, the filters are not effective for distinguishing a cut-off of particles less than a micron. Applicants' claims indicate that the average particle size is less than 100 nm. Thus, filtration using

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state of the art commercial filters is not an effective means of creating the narrow particle size distributions, as disclosed and claimed by Applicants.

In summary, there is no evidence, which can withstand scrutiny, contrary to Dr. Singh's statements regarding the disclosure in the Jaskie patent. The Jaskie patent does not present any experimental results. Almost five years after the Jaskie patent issued, there is no public knowledge of successful application of the Jaskie approach. This failure regarding the practice of the Jaskie invention is objective evidence against the Jaskie suggestion. Applicants have further supported the opinions in Dr. Singh's Declaration by a Declaration by Dr. Bricker, an expert in separation technologies, and by objective evidence, below, regarding the lack of availability of commercial separation approaches suitable to performed the specified particle separations.

Together, the Declarations by Professor Singh and Professor Bricker provide overwhelming objective evidence from a person with considerable experience in the separation of biological nanoparticles as well as the perspective of an expert in inorganic nanoparticle technology that the approach discussed in the Jaskie patent will not work to produce the compositions disclosed and claimed by Applicants. Also, the Examiner failed to establish prima facie obviousness since the Bhargava patent and the Jaskie patent do not disclose zinc oxide. In addition, Applicants have presented a large amount of unchallenged objective evidence that the Jaskie patent does not enable the production of particles with the claimed narrow particle size distribution. Consequently, assuming *arguendo* that prima facie obviousness was established, the un-refuted objective evidence clearly rebuts any showing of prima facie obviousness. In summary, the Examiner has failed to establish prima facie obviousness or the enablement of the production of zinc oxide particles with the claimed average particle size distribution, and to the extent prima facie obviousness has been shown with respect to the particle size distribution, Applicants have presented a large amount of unchallenged evidence rebutting any showing with respect to the particle size distribution.

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The Examiner notes that Applicants have not placed the method of producing the particles in the composition claims. However, this fact is irrelevant to the patentability of the composition claims. If the composition is not new and nonobvious, inclusion of the method may not impart patentability. See MPEP 2113. As described in detail above, if the composition is not in the hands of the public, it is patentable without any reference in the claims to the process. Applicants have shown that the claimed compositions were not in the hands of the public based on the prior art teachings. The claims are therefore patentable as presented.

With respect to claim 2, Applicants have amended the claim to put the claim in independent form. None of the cited references disclose forming zinc oxide particles with an average particle size within the claimed particle size range. Therefore, claim 2 is not prima facie obvious over the prior art of record.

Applicants respectfully request withdrawal of the rejection of claims 1-5, 25 and 26 under 35 U.S.C. §103(a) as being unpatentable over the Bhargava patent in view of the Jaskie patent.

Rejection Over Iga et al. And Jaskie et al.

The Examiner rejected claims 1, 7-9 and 27-30 under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent to Iga et al. (the Iga patent) in view of the Jaskie patent. The Examiner asserts that the Iga patent discloses the claimed invention except for the claimed particle size distribution. The Examiner cited the Jaskie patent for disclosing a particle size distribution within a particular range is within the skill in the art. However, Applicants believe that the Examiner failed to establish a case of prima facie obviousness since there is no motivation to combine the references and since the references do not teach all of the claim elements, in particular the particle size distribution. Applicants present objective evidence that Jaskie does not place the

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presently claims particle size distributions in the hands of the public. Applicants respectfully request reconsideration of the rejection based on the following comments.

First, there is no motivation to combine the references since the Iga patent is directed to ceramics formed from sintering zinc oxide along with other oxides to form varistors while the Jaskie patent does not teach or suggest the usefulness of zinc oxides. Furthermore, the features of the quantum confined particles of the Jaskie patent are lost if the particles are sintered into a ceramic material. Specification of a particular particle size range has no value with respect to forming sintered ceramic varistors. Therefore, the Examiner has failed to establish a prima facie showing of motivation to combine the teachings of the Iga patent and the Jaskie patent as indicated by the Examiner.

Furthermore, the cited references fail to disclose all of the claim elements, specifically the narrow particle size distribution. In particular, the Jaskie patent does not enable the production of narrow particle sizes as claimed by Applicants, as discussed in great detail above. Therefore, the combined disclosures of the Iga patent and the Jaskie patent do not place Applicants' claimed invention in the hands of the public. Since prima facie obviousness has not been established and since any showing with respect to particle size distribution has been rebutted by unrefuted evidence, the combined disclosures of the Iga patent and the Jaskie patent do not render Applicants' claimed invention obvious.

Applicants respectfully request withdrawal of the rejection of claims 1, 7-9 and 27-30 under 35 U.S.C. §103(a) as being unpatentable over the Iga patent in view of the Jaskie patent.

CONCLUSIONS

In view of the foregoing, it is submitted that this application is in condition for allowance. Favorable consideration and prompt allowance of the application are respectfully requested.

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The Examiner is invited to telephone the undersigned if the Examiner believes it would be useful to advance prosecution.

Respectfully submitted,



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March 28, 2002
Date

Shari Thorndike
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ATTACHMENT
MARKED-UP AMENDMENTSpecification As Amended

At page 9, lines 5-16, the paragraph has been amended as follows:

Laser pyrolysis has been performed generally with gas phase reactants. The use of exclusively gas phase reactants is somewhat limiting with respect to the types of precursor compounds that can be used practically. Thus, techniques have been developed to introduce aerosols containing reactant precursors into laser pyrolysis chambers. Improved aerosol delivery apparatuses for reactant systems are described further in commonly assigned and copending U.S. Patent Application Serial Number 09/188,670, now U.S. Patent 6,193,936 to Gardner et al., entitled "Reactant Delivery Apparatuses," filed November 9, 1998, incorporated herein by reference.

At page 16, line 19 to page 17, line 4, the paragraph has been amended as follows:

Aerosol generator 152 can operate based on a variety of principles. For example, the aerosol can be produced with an ultrasonic nozzle, with an electrostatic spray system, with a pressure-flow or simplex atomizer, with an effervescent atomizer or with a gas atomizer where liquid is forced under significant pressure through a small orifice and fractured into particles by a colliding gas stream. Suitable ultrasonic nozzles can include piezoelectric transducers. Ultrasonic nozzles with piezoelectric transducers and suitable broadband ultrasonic generators are available from Sono-Tek Corporation, Milton, NY, such as model 8700-120. Suitable aerosol generators are described further in copending and commonly assigned, U.S. Patent Application Serial No. 09/188,670, now U.S. Patent 6,193,936 to Gardner et al., entitled "REACTANT DELIVERY APPARATUSES," incorporated herein by reference. Additional aerosol generators can be attached

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to junction 156 through other ports 162 such that additional aerosols can be generated in interior 158 for delivery into the reaction chamber.

At page 25, lines 5-22, the paragraph has been amended as follows: (Note that this paragraph was previously amended in the Amendment of August 18, 2000.)

An alternative design of a laser pyrolysis system has been described in copending and commonly assigned U.S. Patent Application No. 08/808,850 now U.S. Patent 5,958,348, entitled "Efficient Production of Particles by Chemical Reaction," incorporated herein by reference. This alternative design is intended to facilitate production of commercial quantities of particles by laser pyrolysis. The reaction chamber is elongated along the laser beam in a dimension perpendicular to the reactant stream to provide for an increase in the throughput of reactants and products. The original design of the apparatus was based on the introduction of gaseous reactants. Alternative embodiments for the introduction of an aerosol into an elongated reaction chamber are described in copending and commonly assigned U.S. Patent application serial No. 09/188,670, now U.S. Patent 6,193,936 to Gardner et al., filed on November 9, 1998, entitled "Reactant Delivery Apparatuses," incorporated herein by reference.

At page 26, line 19 to page 27, line 4, the paragraph has been amended as follows:

The improved reaction system includes a collection apparatus to remove the nanoparticles from the reactant stream. The collection system can be designed to collect particles in a batch mode with the collection of a large quantity of particles prior to terminating production. Alternatively, the collection system can be designed to run in a continuous production mode by switching between different particle collectors within the collection apparatus or by providing for

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removal of particles without exposing the collection system to the ambient atmosphere. An alternative preferred embodiment of a collection apparatus for continuous particle production is described in copending and commonly assigned U.S. Patent application serial number 09/107,729, now U.S. Patent 6,270,732 to Gardner et al., entitled "Particle Collection Apparatus And Associated Methods," incorporated herein by reference. The collection apparatus can include curved components within the flow path similar to curved portion of the collection apparatus shown in Fig. 2.

Claims As Amended

Claim 2 has been amended as follows:

2. (Once Amended) A collection of particles in a powder comprising zinc oxide, the collection of particles having [The collection of particles of claim 1 wherein the collection of particles have] an average diameter less than [from about 5 nm to] about 45 [50] nm.